National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material® 1775

Refractory Alloy MP-35-N

(In cooperation with the American Society for Testing and Materials)

This Standard Reference Material (SRM) is in the form of a disk, approximately 35 mm (1.375 in) in diameter and 12.7 mm (0.5 in) thick intended for use with optical emission and X-ray spectrometric methods of analysis. This material is the same lot as SRM 2175 supplied in chip form.

The certified values for 10 elements are listed in Table 1; reference values for four elements are listed in Table 2; information values for four elements are listed in Table 3. For all elements, values are reported as mass fractions [1]. Value assignment categories are based on the definitions of terms and modes used at NIST for chemical measurement of reference materials [2] and uncertainties are assessed according to the ISO Guide [3]. Table 4 summarizes the analytical chemical methods applied at NIST for the characterization of the composition of this SRM.

Certified Values and Uncertainties: The certified values for cobalt, chromium, nickel, molybdenum, and sulfur were determined by primary methods at NIST with confirmation from either a second NIST method or data from the cooperating laboratories. The certified values for manganese, vanadium, titanium, boron, and iron are certified on the basis of one method at NIST in combination with data from the outside participating laboratories. The uncertainties in the certified values are reported as ku_c, where k is the coverage factor for a 95 % confidence level and u_c is the "combined standard uncertainty" calculated according to the ISO Guide [3]. The value of u_c is intended to represent, at the level of one standard deviation, the combined effect of all the uncertainties in the certified values. For elements certified by multiple independent analytical methods, the procedure of Schiller and Eberhardt was used to combine the data [4].

Reference Values and Uncertainties: The reference values for aluminum, carbon, and copper are derived from data provided by the cooperating laboratories. The reference value for phosphorus is derived from NIST radiochemical neutron activation analysis (RNAA). Uncertainties are calculated in the same manner as for certified values.

Information Values: Information values are provided in Table 3 for niobium, nitrogen, silicon, and tungsten. No uncertainties are reported for these values as there is insufficient information with which to make the appropriate statistical assessments.

Expiration of Certification: The certification of this SRM is valid, within the measurement uncertainties specified, until **01 March 2015**, provided the SRM is handled in accordance with instructions given in this certificate (see Instructions for Use). This certification is nullified if the SRM is damaged, contaminated, or modified in any way other than its intended use.

Instructions for Use: The unlabeled surface of the disk is intended for measurement. The entire area of the surface is certified and measurements may be made at any point on the surface. The material is considered to be homogeneous throughout the entire thickness of the disk. Each packaged disk has been prepared by finishing the unstamped surface with 120 grit zirconium oxide abrasive paper. The user is urged to use care when either resurfacing the disk or performing additional polishing as these processes may contaminate the surface of the disk.

The support aspects involved in the preparation, certification, and issuance of the SRM were coordinated through the NIST Standard Reference Materials Program by N.M. Trahey.

Willie E. May, Chief
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Gaithersburg, MD 20899
Certificate Issue Date: 10 October 2000

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Coordination of the technical work leading to the certification of this SRM was provided by J.D. Fassett of the NIST Analytical Chemistry Division. The analytical measurements were performed by C.M. Beck II, W.R. Kelly, R.M. Lindstrom, J.L. Mann, R.L. Paul, M.L. Salit, J.R. Sieber, and R.D. Vocke, Jr. of the NIST Analytical Chemistry Division.

Statistical analysis of the homogeneity and certification data were provided by H-k. Liu of the NIST Statistical Engineering Division.

Alloy Preparation: UNS R30035 Refractory Alloy MP-35-N (Cr20-Ni35-Mo9, Co balance) was cast, under contract, by Carpenter Technology Corporation, Port Washington, PA, USA. In accordance with NIST specifications, the four cast billet lengths supplied were all the same heat with minimum compositional differences. D.K. Associates, Buffalo, NY, USA, forged, under contract, two of the billet lengths into four rods, 3.5 cm in diameter and ~335 cm in length (1.375 in × ~11 ft). The forged rods were cut into disks by NIST and designated SRM 1775. The two remaining billet lengths were chipped by NIST and designated SRM 2175.

Table 1. Certified Values for SRM 1775

Element	Composition mass fraction (in %)
Chromium	20.472 ± 0.035
Cobalt	33.352 ± 0.027
Iron	0.91 ± 0.10
Molybdenum	9.508 ± 0.012
Nickel	34.911 ± 0.029
Titanium	0.730 ± 0.032
	mass fraction (in mg/kg)
Boron	97 ± 24
Manganese	121 ± 15
Sulfur	13 ± 1
Vanadium	95 ± 14

Table 2. Reference Values for SRM 1775

Element	Composition mass fraction (in %)
Aluminum	0.024 ± 0.003
	mass fraction (in mg/kg)
Carbon	51 ± 11
Copper	46 ± 4
Phosphorus	6 ± 1

Table 3. Information Values for SRM 1775

Element	Composition mass fraction (in %)
Niobium	0.03
Nitrogen	0.002
Silicon	0.02
Tungsten	0.02

Table 4. NIST Analytical Methods

Methods Used	Elements Determined
ICP-OES	Chromium, Cobalt, Molybdenum, Nickel
ID-TIMS	Sulfur
INAA	Chromium, Manganese, Nickel
PGAA	Boron
RNAA	Phosphorus
XRF	Chromium, Cobalt, Iron, Molybdenum, Nickel, Niobium, Titanium, Tungsten, Vanadium

ICP-OES	Inductively coupled plasma optical emission spectrometry
ID-TIMS	Isotope dilution thermal ionization mass spectrometry
INAA	Instrumental neutron activation analysis
PGAA	Prompt gamma activation analysis
RNAA	Radiochemical neutron activation analysis
XRF	X-ray fluorescence spectrometry

Technical Contacts and Participating Laboratories:

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REFERENCES

[1] Taylor, B.N., "Guide for the Use of the International System of Units (SI)," NIST Special Publication 811, 1995 Ed., (1995).

[2] May, W.E., et al., "Definitions of Terms and Modes Used at NIST for Value-Assignment of Reference Materials for Chemical Measurement," NIST Special Publication 260-136, U.S. Government Printing Office, Washington DC, (2000).

[3] *Guide to the Expression of Uncertainty in Measurement*, ISBN 92-67-10188-9, 1st Ed., ISO, Geneva, Switzerland, (1993); see also Taylor, B.N. and Kuyatt, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results," NIST Technical Note 1297, U.S. Government Printing Office, Washington DC, (1994); available at http://physics.nist.gov/Pubs/.

[4] Schiller, S.B. and Eberhardt, KR., "Combining Data from Independent Chemical Analysis Methods," Spectrochimica Acta, **46B**, pp. 1607-1613, (1991).

Users of this SRM should ensure that the certificate in their possession is current. This can be accomplished by contacting the SRM Program at: telephone (301) 975-6776; fax (301) 926-4751; e-mail srminfo@nist.gov; or via the Internet http://www.nist.gov/srm.